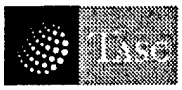

PR-08773-07

TASC ASTT TECHNICAL AND MANAGEMENT MONTHLY PROGRESS REPORT

Progress Report for the Period:

1 January – 31 January 1998

Sponsored by:
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1. INTRODUCTION

This report provides a summary of the progress made during the report period under TASC's three ASTT (Advanced Simulation Technology Thrust) projects:

- MRA (Multiresolution Analysis), CLIN 0001/0002, Whitney
- JETS (JSIMS Environmental Tailoring), CLIN 0003/0004, Ouzts
- FROST (Framework of Reusable Objects), CLIN 0005/0006, Stanzione.

This report contains both Technical (Section 2) and Management / Financial (Section 3) status information, reported individually for each of the three projects.

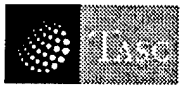
2. TECHNICAL SUMMARY

2.1 MRA - MULTIRESOLUTION ANALYSIS (CLIN 0001/0002)

2.1.1 Technical Accomplishments

During January, we continued to refine our subsystem experiment on terrain intervisibility. We completed a baseline results comparing the impact of terrain resolution on intervisibility between single points (i.e., aggregated force models) and between multiple points (i.e., a single tank platform opposing a disaggregated tank force). Somewhat to our surprise, for the column formation of the multiple-tank force, consistency between the "truth" model (highest resolution terrain) and lower resolution models was not significantly different using aggregated (point-to-point) or disaggregated (point-to-multiple points) force models. We considered force sizes from three to seven tanks and column spacings from 50 to 300 m for this experiment. Future experiments will use different terrain regions and alternative engagement rules to test the generality of this results.

We were notified that our paper summarizing initial results of the intervisibility experiment, submitted in December, was accepted for publication and presentation at the Spring '98 SIW in March. (Paper #SIW201, "Consistency and interoperability in simulations using multi-level, multi-resolution models")



Finally, during January, we began developing our next two subsystem experiments, one involving models of the atmosphere's impact on air-to-ground encounters and one involving encounters between submarines. The former experiment will be based on interactions between an attack aircraft and a SAM site and use both high resolution and very low resolution models of the atmospheric impacts on engagements. The latter experiment will investigate the impact of the spatial resolution of a model of sound velocity variability in the ocean on predicted SNRs at each boat. We prepared briefing material describing both of these experiments for presentation at the ASTT IPR in early February.

2.1.2 Results Obtained Related to Previously Identified Problem Areas

Not applicable.

2.1.3 Technical or Schedule Problem Areas

None.

2.1.4 Activities Planned for the Next Reporting Period

During February we will present a summary of the project to-date at the ASTT IPR. We will continue work on the intervisibility experiment, including use of a new terrain data set and possibly adding the impact of visibility due to atmospheric conditions to the simulations. The latter will be our first test of our hypothesis regarding the interaction between the amount of a priori uncertainty in a scenario and the required SNE resolution for a given consistency at the behavior-level of our Reference Model. We will also begin implementation of the atmosphere and ocean model experiments. This will require extensions of the MOC used for the terrain experiment and/or a new MOC approach.

2.2 JETS - JSIMS ENVIRONMENTAL TAILORING SERVICES (CLIN 0003/0004)

2.2.1 Technical Accomplishments

We are completing the *Environmental Tailoring Requirements Report* to support training needs as they relate to environmental tailoring and, in parallel, we are performing some preliminary tailoring experiments using an NWP model.

Environmental Tailoring Requirements

We have compiled information from multiple sources, including JSIMS documents, STOW'97 requirements, and the recent requirements analysis conducted by the Executive Agent for the Air and Space Natural Environment. A draft report is being written that addresses the dynamic atmosphere and ocean variables, and products that JSIMS will need in its Synthetic Natural Environment. The report also identifies entities and behaviors that are affected by these aspects of the environment using information drawn from the Universal Joint Task List, environmental interaction matrices from STOW'97 and JCOS documents.

Tailoring Experiments Using Nwp Model

We have fully configured a numerical weather prediction (NWP) model (Klemp and Wilhelmson) and have used the model to perform some preliminary tailoring experiments. We will move forward with additional experiments and attempt to tie the results to actual simulations driven by the TAOS system (e.g. ModSAF). A set of weather analyses has been downloaded from MEL (NORAPS model) and will be used to initialize some NWP experiments and to test merging algorithms.

We have performed a preliminary experiment using the Klemp and Wilhelmson NWP model. In the experiment, we initialize the model with a mid-summer Midwestern U. S. environment and allowed the model to evolve for 4 simulation hours (t = 0400). We then continued to run the model out to t = 0800 and called this four hour period from t = 0400 to t = 0800 the Control Environment (CE). The CE represents the state of the atmosphere (as predicted by the model) *without tailoring*.

We then re-ran the model with the goal of inserting a temperature edit of 2° K in a 2 x 2 x 2 km grid volume. Though it is clear that a specified temperature edit of a certain magnitude is not the kind of tailoring we expect from the military community, we are beginning with a clearly defined edit to a prognostic variable so as to eliminate the complication of more sophisticated

tailoring involving several variables or complex representations. These issues will be addressed in the future. We also chose to edit temperature in this preliminary experiment, because we know what to expect physically. Specifically, the insertion of a positive temperature perturbation will induce vertical motion and corresponding transport of energy and momentum.

With these goals and expectations in mind, we ran the model from t = 0400 to t = 0600 inducing the temperature edit to appear at t = 0600. We did this by calculating the difference between the state of the atmosphere (as it evolved) and the state of the atmosphere with the temperature edit and applying some portion of this difference to the temperature field. At t = 0600, the temperature edit, having been forced along the way, contains the edit volume as specified. From t = 0600 to t = 0800, the model was allowed to evolve on its own without any external forcing in order to compare the results with the CE run.

The results of the experiment are as follows:

1. From t = 0400 to t = 0600 (forcing period), the model slowly moved toward the edited environment. Comparison with the CE run revealed that heat and momentum are transported with the mean flow (both upstream and downstream). At t = 0600.
2. From t = 0600 to t = 0800 (post-edit period), the model evolved the temperature edit. Again, heat and momentum were transported with the mean flow, and by t = 0800 at the location of the edit, the temperature perturbations were minimal. However, downstream from the edit, there were significant changes to both the temperature field and the wind flow.

The experiment has revealed some important aspects of the physical correlation between the edited variable and other state variables. In addition, it has shown that we may be able to devise a set of algorithms that could be used in real-time to edit the entire SNE based on the transport of heat, moisture, and momentum in accordance with environmental flow.

We were notified that our paper, *Issues in Tailoring of The Synthetic Natural Environment* (Paper # SIW 219), was accepted for publication in the Spring '98 SIW Proceedings.

2.2.2 Results Obtained Related To Previously Identified Problem Areas

Not applicable.

2.2.3 Technical or Schedule Problem Areas

None.

2.2.4 Activities Planned for the Next Reporting Period

We will complete the *Environmental Tailoring Requirements Report* in February. We will continue to perform tailoring experiments using the NWP model. We will also begin to investigate the use of TAOS and ModSAF for evaluation of tailoring algorithms and multi-resolution and multi-representation issues. With regard to our plans for further investigation of tailoring using the NWP model, we will formulate a detailed experimental plan including types of experiements, expected results, formulation of algorithms using experimental results, and measures of consistency and agreement.

Steve Ouzts will present preliminary technical results at the IPR the week of February 2. He will also update ASTT with financial status and present an overview of the JETS program at a multi-resolution workshop with UK-DERA.

2.3 FROST - FRAMEWORK OF REUSABLE OBJECTS (CLIN 0005/0006)

2.3.1 Technical Accomplishments

Tom Stanzione, Alan Evans, and Forrest Chamberlain continued investigating key issues in the FROST architecture, including data categorization and concurrency. They developed high level GTEMS use cases to help document the functionality necessary in this system. They continued to investigate the JSIMS architecture and Tempo/Thema with respect to the distributed synthetic natural environment.

Robert Coury and Tom Stanzione generated the first draft of the Environmental Interface and Ground Truth Environmental Database specifications document. We focused on the

Environmental Interface functionality and GTED contents, which will be used to define the EI functions and the GTED and ASED object models. We plan to deliver this draft in early February.

Eric Yee and Howard Lu continue experimenting with the SAIC simulation infrastructure software Tempo/Thema, as well as COTS object oriented database products. Eric developed an experimentation plan for evaluating these products for FROST, and we have started the evaluation of ObjectStore and Objectivity. Eric, Howard, Bob, and Forrest attended a half day ObjectStore training class.

The results of our experimentation to date show that Tempo/Thema is limited for use with the distributed SNE for the following reasons:

1. There is currently no support for non-shared memory networking, so all experimentation must take place on a single machine.
2. The Compound Element Database has not yet been implemented, so a different database is needed for each class of SNE object.
3. The Event Distribution mechanism has not been optimized for performance and is very slow.
4. The data structure for events is a fixed size, with no mechanism for breaking up data fields. The database is implemented using events, so all events must use a buffer large enough to hold the largest element in the system, which for the SNE can be very large.
5. There is a hard coded limit of 100 categories, with a large overhead per category. An SNE can require millions of categories.
6. There is currently no mechanism for pushing newly interesting static data into application caches as application interests change, i.e. data is pushed only when the data changes.
7. Only simple user-defined categories are supported. Efficient interest management for SNE requires automated combination of categories at run-time, e.g. all objects of category "tree" and category "in region X".

The results of our experimentation with COTS products is encouraging but still preliminary. The major issue with using a COTS solution is the HLA compliance problem. We are investigating how a COTS solution could be integrated with the RTI, using data from the STOW

ACTD.

During this period, we all worked on preparing for the In Process Review next month.

2.3.2 Results Obtained Related to Previously Identified Problem Areas

Not applicable.

2.3.3 Technical or Schedule Problem Areas

None.

2.3.4 Activities Planned for the Next Reporting Period

In the next reporting period, we will continue with the FROST experimentation, particularly with the COTS products ObjectStore, Objectivity, and Oracle. We should have evaluation copies of all three of these products and will start the comparisons. We will be talking with SAIC and JSIMS concerning the Tempo/Thema limitations and potential improvements and schedules for implementation of these improvements. We will deliver the draft version of the EI and GTEMs specification document, and work on refining this analysis towards the EI specification. Finally, we will participate in the In-Process Review and technical exchange meeting with the UK DERA.

3. MANAGEMENT AND FINANCIAL SUMMARY

3.1 MRA (CLIN 0001/0002)

3.1.1 Cost Element Problem Areas

3.1.2 Program Financial Status*

Work Breakdown Structure or Task Element	Cumulative to Date ($)** Planned Expend	Actual Expend	% Compl	At Completion ($)*** BAC	LRE	Remarks
TOTAL FY97-99 CLIN 0005/0006	302,000	301,439	19.3%	1,560,746	1,560,746	

*** Includes both funding in-hand (FY 97-98) and planned (FY 99).**
**** Excludes cost of money.**
***** Excludes fee and cost of money.**

Based on currently authorized work:

(1)	Is current funding sufficient for the current FY	Yes
(2)	What is the next Fiscal Year's funding requirement at anticipated levels	$720K
(3)	Have you included in the report narrative any explanation of the above data and are they cross-referenced ?	No

3.1.3 Travel and Meetings

Date	Location	Subject

None.

3.1.4 Any Significant Changes to the Contractor Organization or Method of Operation

None.

3.1.5 Summary of Engineering Change Proposal (ECP) Status

None.

3.2 JETS (CLIN 0003/0004)

3.2.1 Cost Element Problem Areas

None.

3.2.2 Program Financial Status*

Work Breakdown Structure or Task Element	Cumulative to Date ($)** Planned Expend	Actual Expend	% Compl	At Completion ($)*** BAC	LRE	Remarks
TOTAL FY97-99 CLIN 0003/0004	178,500	183,116	29.5%	621,413	621,413	

*** Includes both funding in-hand (FY 97-98) and planned (FY 99).**
**** Excludes cost of money.**
***** Excludes fee and cost of money.**

Based on currently authorized work:

(1)	Is current funding sufficient for the current FY	Yes
(2)	What is the next Fiscal Year's funding requirement at anticipated levels	$250K*
(3)	Have you included in the report narrative any explanation of the above data and are they cross referenced ?	No

***Reflects guidance to expect $250 versus original plan.**

3.2.3 Travel and Meetings

Date	Location	Subject
12-13 Jan	Phoenix, AZ	AMS Annual Meeting

Pete Dailey and Steve Ouzts had technical exchanges with several investigators on numerical modeling and weather analysis techniques.

3.2.4 Any Significant Changes to the Contractor Organization or Method of Operation

None.

3.2.5 Summary of Engineering Change Proposal (ECP) Status

None.

3.3 FROST (CLIN 0005/0006)

3.3.1 Cost Element Problem Areas

None.

3.3.2 Program Financial Status*

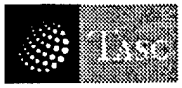
Work Breakdown Structure or Task Element	Cumulative to Date ($)**			At Completion ($)***		
	Planned Expend	Actual Expend	% Compl	BAC	LRE	Remarks
TOTAL FY97-99 CLIN 0005/0006	243,227	258,905	22.9%	1,128,752	1,128,752	

*** Includes both funding in-hand (FY 97-98) and planned (FY 99).**
**** Excludes cost of money.**
***** Excludes fee and cost of money.**

Based on currently authorized work:

(1) Is current funding sufficient for the current FY ? Yes

(2) What is the next Fiscal Year's funding requirement at anticipated levels $545K



(3) Have you included in the report narrative any explanation of the above data and are they cross referenced ? No

3.3.3 Travel and Meetings

Date	Location	Subject
8 Jan	SAIC, Burlington, MA	Discussions with ODI on ObjectStore
22 Jan	SAIC, Burlington, MA	Discussions with ODI on ObjectStore
27 Jan	SAIC, Burlington, MA	Discussions with ODI on ObjectStore

3.3.4 Any Significant Changes to the Contractor Organization or Method of Operation

None.

3.3.5 Summary of Engineering Change Proposal (ECP) Status

None.